Name ________________________
Class ________________________

Problem 1 – Graphical Exploration

On page 1.2, you will see the graph of **f1**(x) = x^n and its derivative. (The graph of **f1** is bold.) Use the slider to change the exponent of **f1** and observe the changes to the graphs.

- What is the relationship between the degree of **f1** and the degree of its derivative?

Problem 2 – Defining the Derivative of x^n

Examine the various derivatives of x^n, where n is an integer, below.

$\frac{d}{dx}\left(x^2\right) = 2 \cdot x$ $\frac{d}{dx}\left(x^3\right) = 3 \cdot x^2$ $\frac{d}{dx}\left(x^4\right) = 4 \cdot x^3$ $\frac{d}{dx}\left(x^5\right) = 5 \cdot x^4$

- What patterns do you observe in the derivatives above?

- Create at least four other "true" examples. Include nonpositive values of n. Test your examples on page 2.3.

- Create a rule for taking the derivative of x^n with respect to x.

On page 2.5, define the function $f(x) = x^n$. Evaluate the limit $\lim_{h\to 0}\left(\frac{f(x+h)-f(h)}{h}\right)$.

- How does this compare to the rule you found for taking the derivative of x^n?

Extension

- Does the Power Rule apply when n is a non-integer, rational number? Use page 3.1 to test your conjecture.

- Expand the binomial $(x + h)^n$. Use this to evaluate the limit you entered on page 2.5.